REMARKS

As a preliminary matter, Applicants assert that the Examiner erroneously indicated in the Office Action Summary that only claims 35, 37-39 and 68 were pending in the application at the time the Office Action was mailed. The Examiner failed to address claims 45, 47-49, 63, 65-67, 69, and 70. While the Board affirmed the Examiner's previous rejection of claims 45, 47-49, 63, 65-67, 69, and 70, none of these claims were canceled at the time the Office Action was issued. Accordingly, the Examiner should have indicated that claims 35, 37-39, 45, 47-49, 63 and 65-70 were pending.

In the Office Action, the Examiner rejected claims 35, 37-39 and 68. Further, the Examiner presumably maintained the previous rejection of claims 45, 47-49, 63, 65-67, and 69. By the present Response, Applicants have amended claims 35, 45, and 66-68, and canceled claims 48, 63, 65, 69 and 70. Upon entry of these amendments, claims 35, 37-39, 45, 47, 49, and 66-68 will remain pending in the present application and are believed to be in condition for allowance. In view of the foregoing amendments and the following remarks, Applicants respectfully request reconsideration and allowance of all pending claims.

Claim Rejections Under 35 U.S.C. § 102

In the Office Action, the Examiner rejected claims 35 and 37 under 35 U.S.C. § 102(e) as being anticipated by Pai (U.S. Patent No. 6,387,728) (hereafter referred to as "the Pai '728 reference"). Applicants respectfully traverse this rejection.

Anticipation under 35 U.S.C. § 102 can be found only if a single reference shows exactly what is claimed. *See Titanium Metals Corp. v. Banner*, 227 U.S.P.Q. 773 (Fed. Cir.1985). For a prior art reference to anticipate under 35 U.S.C. § 102, every element of the claimed invention must be identically shown in a single reference. *See In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir.1990). That is, the prior art reference must show the *identical invention "in as complete detail as contained in the ... claim"* to support a *prima facie* case of anticipation. *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989) (emphasis added). Thus, for anticipation, the cited reference must not only disclose all of the recited features but must also disclose the *part-to-part relationships* between these features.

See Lindermann Maschinenfabrik GMBH v. American Hoist & Derrick, 221 U.S.P.Q. 481, 486 (Fed. Cir.1984). Accordingly, the Applicants need only point to a single element or claimed relationship not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter. A *strict correspondence* between the claimed language and the cited reference must be established for a valid anticipation rejection.

Embodiments of the present technique are directed to semiconductor processing and, more particularly, to a stacked die module and techniques for forming a stacked die module. Application, page 2. Specifically, some embodiments of the present technique are directed to a top-down stacking technique. *See*, *e.g.*, *id.*, pages 10-12. For example, a first die may be lifted by a stacking tip, coated on one side with an adhesive, such as a paste or epoxy, and then coupled to a second die via the epoxy. *See*, *e.g.*, *id.* Thus, a stack of two die may be formed on the stacking tip. *See*, *e.g.*, *id.* Further, an exposed side of the second die may be coated with the adhesive and coupled to a third die and so forth to build a die stack including multiple die. *See*, *e.g.*, *id.* Once a complete stack is formed, it may be cured, and an outer die of the stack, such as the second die in a two-die stack, may be coated with a layer of adhesive to facilitate attachment to a substrate. *See*, *e.g.*, *id.* The first adhesive used to attach each die together in the stack may be different than the second adhesive used to attach the die stack to the substrate. *See*, *e.g.*, *id.* Indeed, the second adhesive may be curable at a lower temperature than the first adhesive. *See*, *e.g.*, *id.* For example, the first adhesive may be cured at 400°C and the second adhesive may be cured at 100°C. *See*, *e.g.*, *id.* This may be desirable because the die stack may be cured prior to attaching the stack to the substrate. *See*, *e.g.*, *id.* Indeed, as would be understood by one of ordinary skill in the art, if the second adhesive were curable at the same temperature or a higher temperature than the first adhesive, the first adhesive would reflow during curing of the second adhesive. Thus, present embodiments are directed to a first adhesive that is curable at a higher temperature than a second adhesive, wherein *the first adhesive couples die together in a die stack* and *the second adhesive couples the die stack to a substrate.*

Accordingly, independent claim 35 recites, *inter alia*, "a stack comprising at least two semiconductor die … coupled together by a first adhesive … curable at a first

temperature; and a substrate coupled to one of the at least two semiconductor die by a second adhesive … curable at a second temperature lower than the first temperature."

In contrast, the Pai '728 reference is directed to attaching a first semiconductor chip to a substrate with a first adhesive layer and attaching a second semiconductor chip to the first semiconductor chip with a second adhesive layer that has a lower maximum exothermic temperature than the first adhesive layer. Pai, col. 2, lines 11-57. In other words, according to the Pai '728 reference, the adhesive layer coupling the first semiconductor chip to the substrate (the first adhesive layer) is curable at a higher temperature than the adhesive layer coupling the first and second semiconductor chips (the second adhesive layer). Thus, the Pai reference clearly does not disclose a die stack including at least *two semiconductor die coupled together by a first adhesive* that is curable at a first temperature, and *a substrate coupled to one of the at least two semiconductor die by a second adhesive* that is curable at *a second temperature lower than the first temperature*. Indeed, according to the Pai '728 reference, a stacked chip package is formed by first attaching a first semiconductor chip to a substrate with a first adhesive layer, partially curing the first adhesive layer between the chip and the substrate, attaching a second semiconductor chip to the first semiconductor chip with a second adhesive layer, curing both adhesive layers, and so forth. *Id.*, col. 2, lines 16-30. Accordingly, if the second adhesive layer of the Pai '728 reference that couples the first and second chips together were curable at a lower temperature than the first adhesive layer coupling the first chip to the substrate, the process described by the Pai '728 reference would fail because curing the second adhesive layer occurs after the first layer is in place between the first chip and the substrate.

In view of the arguments set forth above, Applicants assert that the Pai '728 reference clearly fails to disclose all of the features recited by independent claim 35. Accordingly, for at least the reasons set forth above, Applicants request that the Examiner withdraw the rejection of independent claim 35 and the claim depending therefrom. Further, Applicants request that the Examiner provide an indication of allowance for claim 35 and the claim depending therefrom.

Claim Rejections Under 35 U.S.C. § 103(a)

In the Office Action, the Examiner rejected claim 68 under 35 U.S.C. § 103(a) as being unpatentable over the Pai '728 reference. The Examiner rejected claims 38 and 39 under 35 U.S.C. § 103(a) as being unpatentable over the Pai '728 reference in view of Huang (U.S. Patent No. 6,753,206 B2) (hereinafter referred to as "the Huang reference"). Further, the Examiner rejected claims 38, 39, and 68 under 35 U.S.C. § 103(a) as being unpatentable over the Pai '728 reference in view of Eskildsen (U.S. Pub. 2003/0102567) (hereinafter referred to as "the Eskildsen reference"). Additionally, as set forth above, the Examiner failed to address claims 45, 47, 49, 66, and 67, which remain pending in the present application. Thus, the Examiner presumably maintained the previous rejection of these claims. The Examiner previously rejected claims 45, 47, 49, 66, and 67 under 35 U.S.C. § 103(a) as being unpatentable over Pai (U.S. Patent No. 6,503,776)(hereinafter "the Pai '776 reference"). Applicants respectfully traverse these rejections.

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). To establish a *prima facie* case of obviousness, the Examiner must show, among other things, that the combination includes *all* of the claimed elements. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985).

Applicants assert that the cited references, whether considered separately or in a hypothetical combination, do not disclose *all* of the claimed features of independent claims 38 and 68. For example, independent claims 38 and 68 recite, *inter alia*, "a stack comprising at least two semiconductor die … coupled together by a first adhesive … curable at a first temperature; and a substrate coupled to one of the at least two semiconductor die by a second adhesive … curable at a second temperature lower than the first temperature."

In contrast, as set forth above, the Pai '728 reference is directed to attaching a first semiconductor chip to a substrate with a first adhesive layer and attaching a second semiconductor chip to the first semiconductor chip with a second adhesive layer that has a lower maximum exothermic temperature than the first adhesive layer. Pai, col. 2, lines 11-57. In other words, according to the Pai '728 reference, the adhesive layer coupling the first semiconductor chip to the substrate (the first adhesive layer) is curable at a higher

temperature than the adhesive layer coupling the first and second semiconductor chips (the second adhesive layer). Thus, the Pai reference clearly does not disclose a die stack including *at least two semiconductor die coupled together by a first adhesive* that is curable at a first temperature, and *a substrate coupled to one of the at least two semiconductor die by a second adhesive* that is curable at a second temperature *lower than the first temperature*. Further, none of the secondary references cited by the Examiner remedy this deficiency of the Pai '728 reference. Indeed, the Examiner did not even make such an assertion. For example, it appears that the Examiner merely cited the Huang reference and the Eskildsen reference for alleged teachings related to shingle stacks.

With regard to claim 68, the Examiner stated the following:

> [A]pplicant has not disclosed that his selected thicknesses are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. As such, it would have been obvious to one of ordinary skill in the art to choose these dimensions, since it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.
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> Office Action, pages 3-4.

While Applicants do not agree with the Examiner's assertion with regard to claim 68, Applicants have amended claim 68 to further clarify the claimed subject matter. Additionally, Applicants stress that, as set forth in the specification, present embodiments are directed to a top-down stacking technique. *See*, *e.g.*, *id.*, pages 10-12. For example, a first die may be lifted by a stacking tip, coated on one side with an adhesive, such as a paste or epoxy, and then coupled to a second die via the epoxy. *See*, *e.g.*, *id.* Thus, a stack of two die may be formed on the stacking tip. *See*, *e.g.*, *id.* Further, an exposed side of the second die may be coated with the adhesive and coupled to a third die and so forth to build a die stack including multiple die. *See*, *e.g.*, *id.* Once a complete stack is formed, it may be cured, and an outer die of the stack, such as the second die in a two-die stack, may be coated with a layer of adhesive to facilitate attachment to a substrate. *See*, *e.g.*, *id.* The first die (*e.g.*, the first die lifted by the stacking tip and the die that will eventually be furthest away from the substrate) may be thicker than the second die to act as a stiffener for the die stack. *See*, *e.g.*, *id.* Indeed,

the thicker first die may enhance the overall durability of the die stack and provide structural support during the die stacking process. *See*, *e.g.*, *id.*

With regard to independent claims 45 and 66, Applicants assert that the Examiner's previous rejection is moot in view of the present amendments. Amended claim 45 recites, *inter alia*, "each of the die being coupled to an adjacent die in the stack by a respective layer of a first adhesive ... curable at a first temperature; and a second adhesive disposed on an outer side of the stack to facilitate coupling the stack with the packaging substrate, wherein the second adhesive is curable at a second temperature lower than the first temperature." Amended claim 66 recites, *inter alia*, "the die stack comprises at least two semiconductor die coupled together via a first adhesive that is curable at a first temperature and has been cured; and a second adhesive disposed between the die stack and the substrate that is curable at a second temperature lower than the first temperature."

Applicants assert that none of the cited references disclose the recited features of claims 45 and 66. For example, the Pai '776 reference clearly does not include any teaching related to such features. Further, as discussed in detail above, the Pai '728 reference is merely directed to attaching a first semiconductor chip to a substrate with a first adhesive layer and attaching a second semiconductor chip to the first semiconductor chip with a second adhesive layer that has a lower maximum exothermic temperature than the first adhesive layer. Pai, col. 2, lines 11-57.

In view of the arguments set forth above, Applicants request that the Examiner withdraw the rejection of claims 38, 39, 45, 47, 49, and 66-68. Further, Applicants respectfully request that the Examiner provide an indication of allowance for claims 38, 39, 45, 47, 49, and 66-68.

Payment of Fees and General Authorization for Extensions of Time

If any additional fees, including fees for extensions of time and other reasons, are deemed necessary to advance prosecution of the present application, at this or any other time, Applicants hereby authorize the Commissioner to charge such requisite fees to Deposit Account No. 06-1315; 01-0752.01/FLE (MICS:0078-1). In accordance with 37 C.F.R.

§ 1.136, Applicants hereby provide a general authorization to treat this and any future reply requiring an extension of time as incorporating a request thereof.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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